WeatherMaster 2000 Handbook

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Environdata
ENVIRONMENTAL MONITORING & MANAGEMENT

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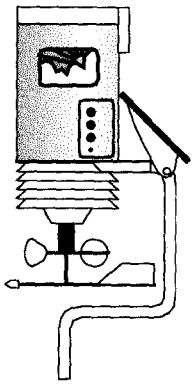


1. Introduction

Welcome to Environdata. We appreciate your purchase of our WeatherMaster 2000 system, and trust that it will give you long and useful service. We welcome your comments and suggestions at any time. If you experience any difficulties in installing and using the WeatherMaster, please contact us immediately so that we can provide a solution for you.

No doubt you're keen to install your new weather station, and reading Chapter 2 will give you basic instructions on how to do this. However, we strongly recommend that you read Chapter 3 first to give you an understanding of how the WeatherMaster 2000 works.

We wish you well with your application, and hope that the WeatherMaster 2000 is all that you expect it to be, and more.

2. Quick-start Guide

2.1 Overview

The WeatherMaster 2000 has been specially designed for ease of installation, and you will find that once you have followed the installation procedure, re-siting your station should be easy if you ever need to do this.

Important: Starting the Weather Station
The Weather Station is delivered calibrated with its program file loaded. However, the Weather Station is shut down during transit, so it will need to be started again. This can be done before installation, or while the system is installed in the field. Normally, connecting a computer will start the WeatherMaster, indicated by a 2-second flash rate. This requires that the computer system is set correctly. If this is not possible, a start plug can be used to start the WeatherMaster.

The first step towards installing your WeatherMaster will be to become familiar with the software supplied with your station, and optionally to install it on to the hard disk of your laptop/notebook/desktop IBM compatible computer. You should become familiar with the software immediately, because you will need to connect your laptop computer to the station on-site during installation and set-up.

2.2 Software Installation

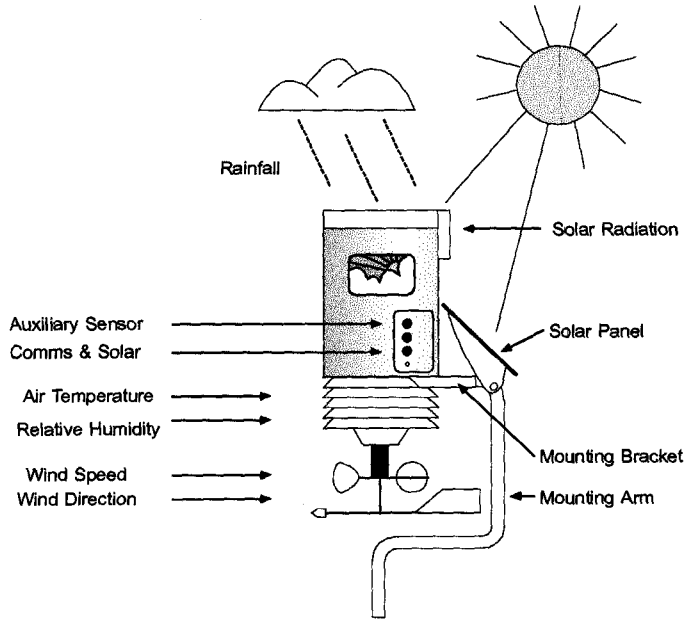
Step 1 - Caring for your disk(s)
Floppy Disks
Please make a backup copy of any floppy disk(s) supplied to you by Environdata. This will protect you in case the original becomes damaged. If necessary, consult your operating system's manual for instructions on how to copy a disk.
CD-ROMs
Please ensure that any CD-ROMs supplied by Environdata are stored in a secure place. It is also a good idea to make a copy of these.

Step 2 - Installing and using the EasiAccess software
To install the software, first check that you have sufficient free space. There must be at least 20Mb free. If there is not, please clear some room before continuing. Consult your operating system's manual for instruction about how to free disk space.

Now, follow the instructions supplied with Environdata's EasiAccess software. See Page 3 of the EasiAccess Quick Start Guide in your manual.

2.3 Assembling the System

The WeatherMaster 2000 is shipped without the Mounting Arm, Solar Panel, Wind Speed Cups and Wind Direction Vane attached. This is to ensure that these items are not damaged during transit or installation. Please retain the packaging carton, as it has been specifically designed to protect the weather station, especially the spindle, during transport.

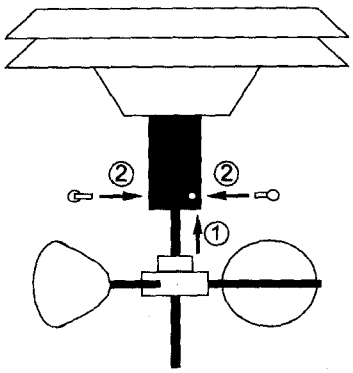


2.3.1 Assembling the Wind Speed cups

The Wind Speed cups need to be mounted on to the lower shaft.
This is achieved by threading the cup assembly on to the shaft, and then sliding it up until the inner hub fits up into the delrin (black plastic) piece.

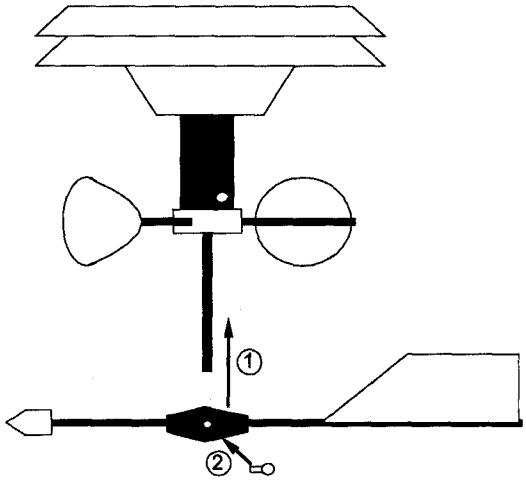
The recessed mounting screws can then be tightened until the cup assembly is captured in the delrin piece.

Once mounted, spin the cups a few times to ensure they are free to turn under the influence of airflow.



2.3.2 Assembling the Wind Direction vane

Once the Wind Speed Cups have been mounted, the Wind Direction vane needs to be threaded on to the shaft and slid upwards until the vane's hub just covers the end of the shaft. The actual vane should be facing upwards, and there should be sufficient clearance between the vane and cups to ensure correct operation. Check that the vane moves freely under the influence of airflow.



2.4 Siting the WeatherMaster 2000

The weather station will accurately measure its own immediate environment, regardless of its surroundings. However, choosing an open environment will mean the data collected will be more representative of the wider area, rather than the immediate vicinity.

Guidelines for choosing a suitable site include:
Flat, level ground at least 20 metres by 20 metres
Trees, bushes and other obstacles at least four times their own height away
Preferably, a minimum of dust and other pollutants
Secure from the intrusion of animals

There are situations where the application demands that the weather station be sited within a confined area to measure the ensuing microclimate, an example of which is between rows within a vineyard.

In situations like this the above guidelines can be ignored, although you must be aware that the resulting data will be indicative of the immediate area only, and should be identified as such. Be sure to consider that, unless it is unavoidable, the weather station's solar panel should not be shaded from sunlight during the sunniest periods of the day between 9am and 3pm.

Mounting the Weather Station

The standard mounting pole is designed to be concreted into the ground. This will provide the most rigid and stable long-term mounting. An alternative short-term mounting, consisting of a metal post (star picket) and four guy wires is also available. See Chapter 5 for detailed instructions.

2.5 Starting the WeatherMaster 2000

The WeatherMaster 2000 is supplied switched off. Connecting a computer and initially communicating with the WeatherMaster is all that is required to start the WeatherMaster.

Tip: Connecting Pin 6 to Pin 4 on the RS232 communications port will activate the weather station if you don't have a computer. See Appendix A for pin details.

2.6 Connecting a computer

A communications cable [CB40] is supplied with the system to connect the WeatherMaster 2000 to the serial port [COM port] of a PC [9 pin "D" type connector.] For older PCs with a 25 pin "D" type connector, a 9-25 pin converter is supplied.

Very recent computers might not have a serial or COM port. These computers have a USB [Universal Serial Bus] port instead, for which a USB-serial converter is required. These are generally available from local computer dealers. Alternatively, Environdata can supply one, at an approximate cost of $100.00.

A test plug, also known as a "loop" plug, is supplied, attached to the communications cable [CB40]. When this plug is connected to the CB40 in place of the weather station, it "loops" or returns any signals sent from the computer back to the computer. This allows the user to test the computer, its settings, and the communications cable, independently of the weather station. See EasiAccess software for more information. [Select the Setup menu – Configuration – Communications.]

2.7 Setting the North Point for Wind Direction

Once the WeatherMaster 2000 is installed, it is necessary to orient the wind direction sensor by setting the North point.

Step 1 - Preparing the program
Make sure EasiAccess is running on your computer, and that you are connected to the weather station

Step 2 - Preparing the vane
Spin the Wind Direction Vane completely around twice, and then point it due north.
It is important that the vane be pointing exactly north. If this is not the case during this calibration procedure, then all subsequent Wind Direction measurements taken by the weather station will be inaccurate.

Step 3 - Setting the North point
While holding the vane in the north position, select the "Set the wind direction North point" option from the Tools Menu. Be sure to keep holding the vane so that it is pointing north until the program has finished calibrating the weather station.

2.8 Checking the WeatherMaster 2000

Once the system is running, you should check the current date and time, and all the sensors to ensure they are working correctly. By following the steps outlined below, you can be sure your system will provide true and reliable data. If, during any of the following steps, you are unsure whether the readings you are getting are correct, please contact Environdata on (07) 4661 4699.

Step 1
Start up the software supplied, connect to the weather station.

Typical Ranges of Current Readings
Check that the reading you are receiving from the station is correct. [Note that sensor readings are updated once every 3 seconds while the display is shown, but normally only once every minute.] The table below shows typical ranges for all the sensors - if you get any readings outside these ranges, contact Environdata.

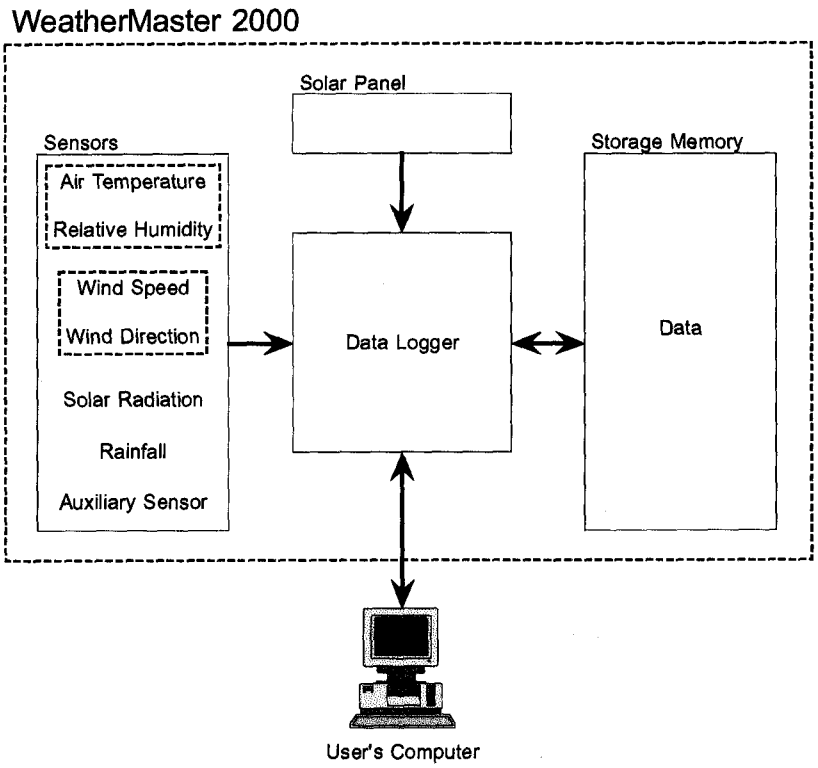
Sensor	Action	Typical Range
Air Temperature	None	0 - 40C
Relative Humidity	None	10 - 90%
Wind Speed	Spin by hand	0 – 20 kph
Wind Direction	Rotate by hand	0 - 360
Rain Gauge *	Pour in water (be sure to have a collection container ready if done indoors)	0.2mm per tip or 6.5mL water poured in
Solar Radiation	Place in direct sunlight	500 - 1200 W/m2 in bright sunlight, 0 inside
Battery Voltage		6 - 7 volts, under 6 volts is flat
Solar Panel		6 - 7.5 volts in sunlight, 0.5 in shade

* Readings from the rain gauge are only updated every minute, even when connected.

3. System Overview

3.1 System Configuration

The WeatherMaster 2000 arrives as a complete, self-contained system, which makes installation and set-up much easier. However, it will still be useful for you to understand a little about the internal structure of the WeatherMaster and its sensors.



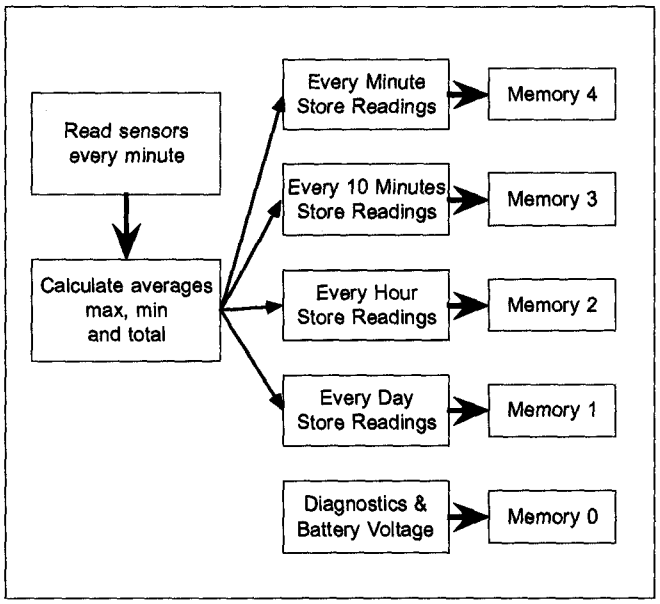
3.2 Logging System

The central component of the weather station is a microprocessor data logger, which coordinates all the activities of the weather station. The data logger collects readings from the sensors, checks the sensors' calibration, accumulates values if they need to be averaged or totaled, and then stores them into memory.

The data logger is equipped with its own internal battery to ensure that data can be recorded and retained for long periods of time without interruption. This battery is charged during sunny periods by the solar panel.

The data logger is also responsible for communicating with the user's computer to transfer [download] data stored in the logger's memory and to display current sensor readings.

3.3 Logging Program



The WeatherMaster 2000's powerful microprocessor is capable of monitoring a number of sensors while also storing data and communicating with a user's computer.

The data logger reads the sensors and maintains an up to date record of the current readings from each sensor every minute. Totals, averages, maximums or minimums of these readings can be calculated over a number of periods of time, and the results can be recorded at rates ranging between once a minute and once a day.

There are four memories available for storing main memory data.

Each of these memories is configured as a "rolling drum". This means that over time the memory will accumulate data, and once it is full it will roll around and begin to overwrite the earliest stored data. Thus, the memory should be downloaded before it is full, or the earliest data recorded will be lost.

The rolling drum system is similar to a revolving drum chart recorder, because once the drum has done a complete rotation it will begin to overwrite the earliest data. Only a certain number of values can be stored within the memory, so old values will be sacrificed in favour of new ones.

Normally, daily data is stored into Memory 1 at 9 am, and hourly data stored into Memory 2 on the hour. Data can also be collected more often than once an hour. However, this will use more memory and reduce the overall period that data can be stored before downloading is required.

If data needs to be collected more often than once an hour, 10-minute data is normally stored into Memory 3, and if required, 1-minute data is stored into Memory 4.

As well as the four standard memories, there is a special diagnostic memory [Memory 0] into which diagnostic information about the weather station is recorded. One of the values that are

regularly stored either in this memory or in the daily summary [Memory 1] is battery voltage. This allows a record to be kept to check the battery is in good condition.

3.4 Power System

The WeatherMaster 2000 is designed to be a self-contained system requiring very little maintenance. However, it is still necessary to understand some of the issues affecting the battery life of the weather station.

The solar panel on the WeatherMaster 2000 should provide enough power to keep the system charged and running indefinitely. This assumes that the solar panel will not be in the shade, or in overcast conditions for more than 2 weeks at a time.

If the WeatherMaster 2000 is to be stored for a period of time without recording data, or if the system is to be disconnected from its solar panel, or stored in a dark place, it will be necessary to place the system into shutdown mode.

In this state all logging stops and the system goes into a low power mode, allowing it to last without solar power.

Select the "Shutdown Logger" menu option with the software supplied. When the program indicates that shutdown has been achieved, check that the indicator LED on the side of the WeatherMaster has stopped flashing. If the LED has stopped flashing, the communications cable can be disconnected and the system can be stored.

The WeatherMaster can easily be re-started and returned to normal operation by connecting the communications cable to the station and, using the EasiAccess program, clicking on the button to connect to the station.

When in shutdown mode, the system's battery should last about 6 months without being recharged by the solar panel. During normal operation, it should last about 4 weeks.

The system incorporates a number of special features to reduce its power consumption. However, these features become ineffective while the logger is communicating with a user's computer. This means that the system's power consumption increases by a factor of 10 while the user is downloading data.

For this reason, it is advisable not to leave a computer connected to the WeatherMaster for long periods of time, unless this is absolutely necessary. If a computer is left connected, the time the system can last without solar energy will be reduced.

Environdata supplies a mains charger as a standard item with your system. Use this to recharge the battery if it is flat [not flashing]. You should also use this if you operate your system indoors, as the solar panel is only effective outside in direct sunlight.

If leaving the system in storage for more than a few months, the best decision is to leave the WeatherMaster permanently connected to the mains charger.

4. Sensors

4.1 Air Temperature/Relative Humidity

The WeatherMaster 2000 contains both an Air Temperature, and a Relative Humidity sensor. These sensors are actually combined internally, but for all intents and purposes can be considered to be two separate sensors.

The Air Temperature sensor has a resolution of 0.1° C and an accuracy of ± 0.5° C. Long-term stability is expected, and the sensor should be reasonably immune to external factors. One situation, which will have an adverse impact on the sensor's accuracy, is if dew condenses on to the sensing tip. This will result in a temporary 'wet bulb' reading which will return to normal once the dew dries.

The Relative Humidity sensor has a resolution of 0.1%, with an accuracy of ± 3% or better. Unfortunately, this sensor is inherently susceptible to external factors because its sensing tip needs to absorb moisture from the surrounding atmosphere. In so doing, it absorbs air-borne pollutants. Thus, despite a filter on the sensing tip, the sensor will lose calibration over a period of time. A typical symptom of loss of calibration is readings that are regularly in excess of 100%.

The RH sensor is also susceptible to the formation of condensation on its sensing tip. When this occurs, the RH reading will quite likely exceed 100% for a period of up to a few hours. This is unavoidable, and the reading will come back within range as the condensation evaporates.

Depending on the cleanliness of air in the weather station's environment, the RH sensor should last approximately 30 months before needing replacement.

Dew effects will most likely occur during early morning and the hours around sunrise. If RH reading deviations occur consistently for periods outside these times, please contact Environdata for technical advice.

The Air Temperature and Relative Humidity sensors are designed as a module that can be easily removed and returned to Environdata if necessary. In this event, refer to section 9.3, and consult with an Environdata technician. Apart from this, there is no regular maintenance required.

4.2 Rain Gauge

The Rain Gauge has a resolution of 0.2 mm, and this should be stable over time.

The system will require regular maintenance, which consists of keeping the funnel free from any foreign matter that falls into it, and checking the water path.

The Rain Gauge funnel has a filter in the middle, which should stop anything getting inside that might block the water path. However, it is possible for enough material to build up at this filter to obstruct water flow into the sensor. Leaves and any other material should be disposed of before taking this filter out.

Once all leaves, etc., have been removed, the filter can be lifted out, cleaned, and re-inserted.

It is important that you check the Rain Gauge every time you visit the station. Otherwise, you could be getting zero rainfall readings for some time before you notice a blockage.

4.3 Wind Speed/Wind Direction

The Wind Speed sensor has a resolution of 0.1 km/h, and a start-up velocity of less than 2 kilometres per hour.

Earlier [optical] Wind Direction sensors have a resolution of 6 Degrees, ± 3 Degrees.

More recent Wind Direction sensors [since April 2001] use a resistance winding [potentiometer]. Resolution for this model is 1-2 degrees, with an accuracy of ± 5 degrees. There is also approximately a 10-degree gap between the start and end of the winding. This is not necessarily at North when the system is calibrated on-site, and results in an arbitrary direction in which the 10 degrees result in a constant direction reading.

Once fitted during installation, the Wind Speed and Direction sensors should require no further maintenance. However, it is important to check regularly that they are both still turning freely under the influence of airflow.

4.4 Solar Radiation

The Solar Radiation sensor has a resolution of approximately 15 W/m^2.

It is important to keep the top of the sensor clean by wiping it with a soft cloth or tissue on site visits, to allow satisfactory light penetration. Otherwise, this sensor should require little maintenance throughout its lifetime. It is also important that the weather station is mounted plumb vertical. If it is not, the sensing surface of the Solar Radiation sensor will not be horizontal, and the resulting readings will be flawed.

4.5 External Sensor (Optional)

The WeatherMaster 2000 includes a facility to allow connection of one external sensor from Environdata's standard range of sensors - e.g., leaf wetness, barometric pressure, soil temperature, etc. - or from certain other manufacturers' sensors.

Because of the WeatherMaster's low power consumption and various other factors, there are limitations to the type of external sensor that can be connected to the auxiliary sensor port. Sensors, which monitor sporadic events, such as rain gauges, are not suitable.

Please consult Environdata to find out if the additional sensor you are considering is compatible with the WeatherMaster 2000.

The external sensor is only powered up for 4 seconds each minute - 1-second warm-up time and 3 seconds measurement time. If you wish to test the voltage supply to this sensor, you can activate it continuously. In the EasiAccess program. Select the communications terminal [F2]; connect to the station [F3], and after receiving the sign-on message, type:

TEST<space>1<space>1<enter>

Note that this might draw a high current from the battery continuously and will flatten the battery if it is left on for more than a few hours. To cancel test mode, type:

TEST<enter>

Alternatively, just disconnect the communications cable.

5. Installation guide

5.1 Installation Overview

Installation will normally take 2 – 4 hours. You will need the following basic tools:
Quick-set concrete
Spade
Small shifting spanner
Screwdrivers [Philips head]
Compass
Laptop computer or Data Courier

5.2 Siting the WeatherMaster 2000

The weather station will accurately measure its own immediate environment, regardless of its surroundings. However, choosing an open environment will mean the data collected will be more representative of the wider area, rather than the immediate vicinity.

Guidelines for choosing a suitable site include:
Flat, level ground at least 20 metres by 20 metres
Trees, bushes and other obstacles at least four times their own height away
Preferably, a minimum of dust and other pollutants
Secure from the intrusion of animals

There are situations where the application demands that the weather station be sited within a confined area to measure the ensuing microclimate, an example of which is between rows within a vineyard.

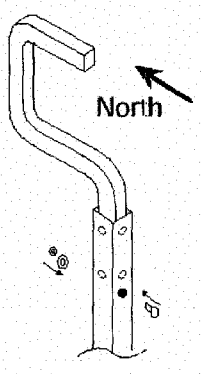
In situations like this the above guidelines can be ignored, although you must be aware that the resulting data will be indicative of the immediate area only, and should be identified as such. Be sure to consider that, unless it is unavoidable, the weather station's solar panel should not be shaded from sunlight during the sunniest periods of the day between 9am and 3pm.

5.3 Mounting the WeatherMaster 2000

The standard mounting pole is designed to be concreted into the ground. This will provide the most rigid and stable long-term mounting. An alternative short-term mounting, consisting of a metal post (star picket) and four guy wires is also available.

5.3.1. Installation of Standard Mount

Step 1 - Site preparation
Dig an appropriately sized hole approximately 0.5 metres deep.



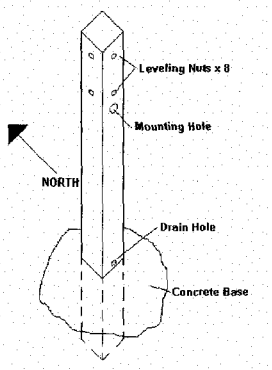
Step 2 - Foundation
Cement the post into the hole, with the drainage holes in the post just above ground level. For installations in the southern hemisphere, it is ***very important*** to ensure that the sides of the post with the mounting holes in it face **due South and due North.** The post must also be plumb vertical.

Step 3 - Assembly
Once the cement has set, insert the mounting arm in the top of the mounting post so that the lower hole in the mounting post lines up with the hole nearest the end of the

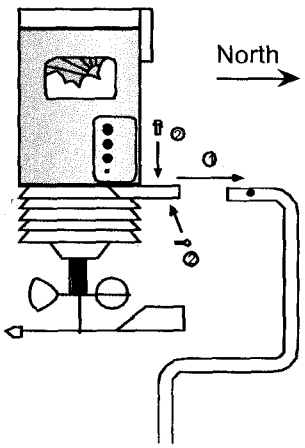
mounting arm. Insert the bolt right through the mounting post and the mounting arm, add the washer and nut, and do up tight.

Step 4 - Mounting
Slide the weather station mounting bracket over the mounting arm and fix in place using four (4) M5x12mm bolts provided.

Step 5 - Leveling Procedure
Insert the eight (8) M6 x 12mm SS bolts into the eight (8) welded nuts at the top of the mounting post. Using the level on the Wm20 mounting bracket, Adjust these eight (8) bolts until the bubble in the level is centered.



NOTE: These are not mounting bolts (only levelling bolts) and should be done up only "finger-tight." Doing up the bolts too tightly might result in the loss of damping provided by the rubber layer around the gooseneck bracket. Then, vibration due to wind might cause the rain gauge's tipping mechanism to tip, giving unexpected and inaccurate rainfall registrations.



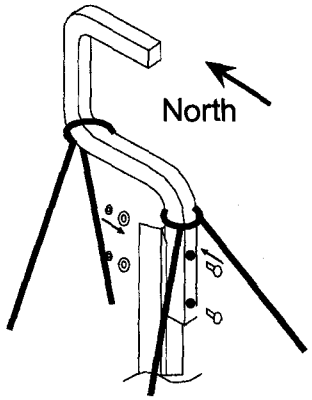
Bolt the solar panel on to the mounting arm. The solar panel should face North for installations in the southern hemisphere. Adjust its vertical angle to suit the approximate latitude of the site. That is, if the weather station is at the equator, the solar panel should be horizontal, and at a latitude of 45 degrees, the panel should be at 45 degrees to the horizontal. This is important because it ensures that the solar panel will receive sufficient sunlight during both summer and winter.

5.3.2 Installation of Short-term Tripod Mount

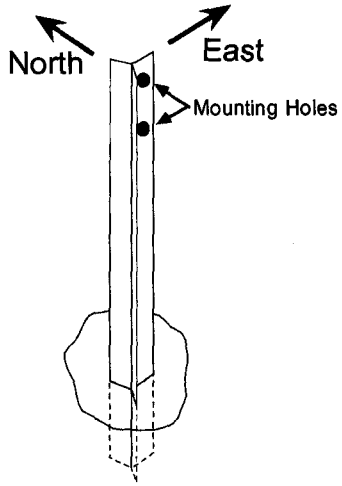
Step 1 - Positioning
Position the tripod on firm ground with its legs fully extended. Using a spanner adjust the height of the central post so that the Weatherstation will be about 180cm above ground, and secure with the captive-pin attached. Position the post so that it can be guyed securely to allow the "gooseneck" to point NORTH [see next page].

Step 2 - Guying
Do not guy the gooseneck as shown on the next page. Using the fitted shackles, guywires and pegs provided guy the tripod securely.

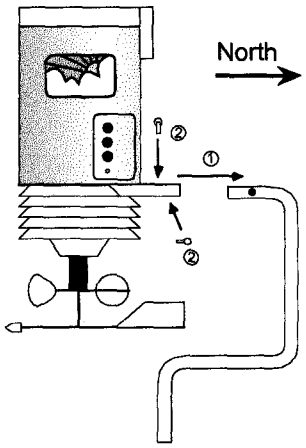
IT IS IMPORTANT TO SECURE THE MOUNTING SAFELY AND TO MAINTAIN ITS ORIENTATION



Step 3 - Mounting



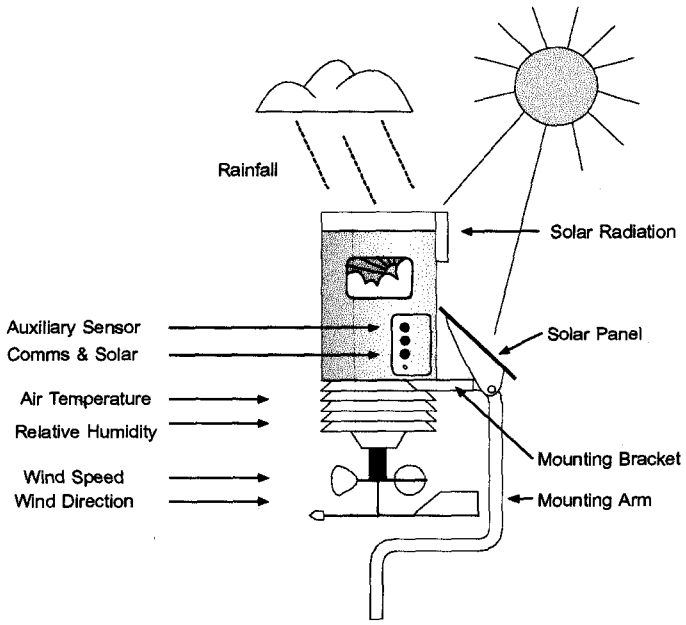
Slide the weather station mounting bracket over the mounting arm and tighten up the two bolts.



Bolt the solar panel on to the mounting arm. The solar panel should face North for installations in the Southern Hemisphere. Adjust its vertical angle to suit the approximate latitude of the site. That is, if the weather station is at the equator, the solar panel should be horizontal, and at a latitude of 45 degrees, the panel should be at 45 degrees to the horizontal. This is important because it ensures that the solar panel will receive sufficient sunlight during both summer and winter.

5.4 Final Assembly of the WeatherMaster 2000

The WeatherMaster 2000 is shipped without the Mounting Arm, Solar Panel, Wind Speed Cups and Wind Direction Vane attached. This is to ensure that these items are not damaged during transit or installation. Please retain the packaging carton, as it has been specifically designed to protect the weather station, especially the spindle, during transport.

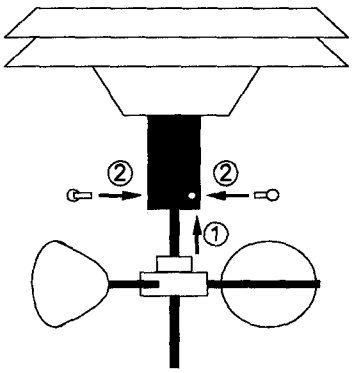


5.4.1 Assembling the Wind Speed cups

The Wind Speed cups need to be mounted on to the lower shaft.
This is achieved by threading the cup assembly on to the shaft, and then sliding it up until the inner hub fits up into the delrin (black plastic) piece.

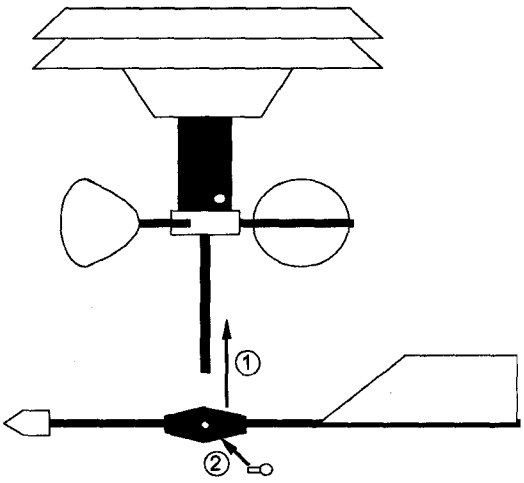
The recessed mounting screws can then be tightened until the cup assembly is captured in the delrin piece.

Once mounted, spin the cups a few times to ensure they are free to turn under the influence of airflow.



5.4.2 Assembling the Wind Direction vane

Once the Wind Speed Cups have been mounted, the Wind Direction vane needs to be threaded on to the shaft and slid upwards until the vane's hub just covers the end of the shaft. The actual vane should be facing upwards, and there should be sufficient clearance between the vane and cups to ensure correct operation. Check that the vane moves freely under the influence of airflow.



5.5 Setting the North Point for Wind Direction

Once the WeatherMaster 2000 is installed, it is necessary to orient the wind direction sensor by setting the North point.

Step 1 - Preparing the program
Make sure EasiAccess is running on your computer, and connected to the weather station

Step 2 - Preparing the vane
Spin the Wind Direction Vane completely around twice, and then point it due north.
It is important that the vane be pointing exactly north. If this is not the case during this calibration procedure, then all subsequent Wind Direction measurements taken by the weather station will be inaccurate.